Fabrication of a uniform large scale array of X-ray microcalorimeters for the X-IFU instrument on Athena

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Abstract

Future space-based imaging X-ray spectrometers, such as the X-IFU (X-ray Integral Field Unit) instrument on ESA's Athena mission, will be based on large format arrays consisting of more than 3800 Transition Edge Sensor (TES) microcalorimeters. We present an optimized lithographic fabrication route that enables the realization of such large format arrays of microcalorimeters. We improved on process steps concerning the X-ray absorber, the stripline wiring system and the silicon grid support structure. We have developed an electroplating process for the fabrication of free standing cantilevered X-ray, which leads to a uniform absorber film thicknesses over the large array. We also developed and fabricated high density Nb/SiO₂/Nb striplines to wire a 4000 pixel array. We report on the optimization of the deep reactive ion etching step to form the silicon grid structure, which allows the production of uniform silicon grids accommodating an array of 4000 TES pixels.

Conclusions

Future space-based imaging X-ray spectrometers will be based on large format arrays consisting of more than 3800 pixels. SRON has the facilities for the production of these large arrays. We also optimized our lithographic fabrication process to enable the production of uniform large TES arrays. The SRON fabrication team is ready for the (X-ray) future.

Acknowledgements

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